Appl. No. 09/496,990
Amdt. Dated 01/24/2005
Reply to Office action of 10/05/2004

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1.   (previously presented)   An apparatus to control connection admission for a connection request in a network, the apparatus comprising:

a first estimator to estimate an equivalent cell rate (ECR) based on description of the connection request, the description including a booking factor;

a second estimator to estimate a measured utilization factor for admitted connections in the network using measurements of data streams arriving at queues and the booking factor; and

a controller coupled to the first and second estimators to generate an admission decision for the connection request based on the estimated ECR and the estimated measured utilization factor.

2.   (Original)   The apparatus of claim 1 wherein the description of the connection request further includes a connection descriptor and a quality of service (QoS) descriptor.

3.   (Original)   The apparatus of claim 2 wherein the connection descriptor includes at least one of a cell rate, a transport device speed, a queue depth, a cell loss ratio, and a link capacity.

4.   (Original)   The apparatus of claim 2 wherein the cell rate is one of a peak cell rate (PCR), a sustained cell rate (SCR), a maximum burst size (MBS), and a minimum cell rate (MCR).

5.   (Original)   The apparatus of claim 4 wherein the QoS descriptor is one of a constant bit rate (CBR), a real-time variable bit rate (rt-VBR), a non-real-time variable bit rate (nrt-VBR), an unspecified bit rate (UBR), an available bit rate (ABR), and a guaranteed frame rate (GFR).

Docket No: 081862.P173   Page 2 of 17   TVN/tn

6.   (Original)   The apparatus of claim 5 wherein the first estimator comprises:

a scale factor generator to provide a scale factor, the scale factor generator comprising a look-up table having entries computed for the QoS descriptor, the entries being indexed by the connection descriptor; and

a scaler coupled to the scale factor generator to scale the cell rate corresponding to the QoS using the scale factor , the scaled cell rate corresponding to the estimated ECR.

7.   (Original)   The apparatus of claim 6 wherein the look-up table is one of a CBR look-up table and a VBR look-up table, the CBR look-up table corresponding to the CBR, the VBR look-up table corresponding to the VBR.

8.   (Original)   The apparatus of claim 7 wherein the CBR look-up table is indexed by a cell rate parameter and the transport device speed, the cell rate parameter being within a range from unity to the PCR.

9.   (Original)   The apparatus of claim 8 wherein the scale factor is one of the entries indexed by the cell rate parameter and the transport device speed.

10.   (Original)   The apparatus of claim 7 wherein the VBR look-up table is indexed by a first ratio between the queue depth and the MBS and a second ratio between the link capacity and the PCR.

11.   (Original) The apparatus of claim 10 wherein the scale factor is a weighted value from entries nearest to an entry corresponding to the first and second ratios when there is no exact match with at least one of the first and second ratios.

12.   (Original)   The apparatus of claim 1 wherein the second estimator comprises:

a capacity estimator to estimate a minimum resource needed for the admitted connections meeting quality of service (QoS) requirements within a measurement window; and

a measured utilization factor generator coupled to the capacity estimator to generate the measured utilization factor using the estimated minimum resource and measurement parameters.

13.   (previously presented)   A method to control connection admission for a connection request in a network, the method comprising:

estimating an equivalent cell rate (ECR) based on description of the connection request, the description including a booking factor;

estimating a measured utilization factor for admitted connections in the network using measurements of data streams arriving at queues and the booking factor; and

generating an admission decision for the connection request based on the estimated ECR and the estimated measured utilization factor.

14.   (Original)   The method of claim 13 wherein the description of the connection request further includes a connection descriptor and a quality of service (QoS) descriptor.

15.   (Original)   The method of claim 14 wherein the connection descriptor includes at least one of a cell rate, a transport device speed, a queue depth, a cell loss ratio, and a link capacity.

16.   (Original)   The method of claim 14 wherein the cell rate is one of a peak cell rate (PCR), a sustained cell rate (SCR), a maximum burst size (MBS), and a minimum cell rate (MCR).

17.   (Original)   The method of claim 16 wherein the QoS descriptor is one of a constant bit rate (CBR), a real-time variable bit rate (rt-VBR), a non-real-time variable bit rate (nrt-VBR), an unspecified bit rate (UBR), an available bit rate (ABR), and a guaranteed frame rate (GFR).

18.   (Original)   The method of claim 17 wherein estimating the ECR comprises:

providing a scale factor using a look-up table, the look-up table having entries computed for the QoS descriptor, the entries being indexed by the connection descriptor; and

scaling the cell rate corresponding to the QoS using the scale factor, the scaled cell rate corresponding to the estimated ECR.

Appl. No. 09/496,990
Amdt. Dated 01/24/2005
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19.   (Original)   The method of claim 18 wherein the look-up table is one of a CBR look-up table and a VBR look-up table, the CBR look-up table corresponding to the CBR, the VBR look-up table corresponding to the VBR.

20.   (Original)   The method of claim 19 wherein the CBR look-up table is indexed by a cell rate parameter and the transport device speed, the cell rate parameter being within a range from unity to the PCR .

21.   (Original)   The method of claim 20 wherein the scale factor is one of the entries indexed by the cell rate parameter and the transport device speed.

22.   (Original)   The method of claim 19 wherein the VBR look-up table is indexed by a first ratio between the queue depth and the MBS and a second ratio between the link capacity and the PCR.

23.   (Original)   The method of claim 22 wherein the scale factor is a weighted value from entries nearest to an entry corresponding to the first and second ratios when there is no exact match with at least one of the first and second ratios.

24.   (Original)   The method of claim 13 wherein estimating the measured utilization factor comprises:

       estimating a minimum resource needed for the admitted connections meeting quality of service (QoS) requirements within a measurement window by a capacity estimator; and

       generating the measured utilization factor using the estimated minimum resource and measurement parameters by a measured utilization factor generator.

25.   (previously presented)   A computer program product comprising:

       a computer usable medium having computer program code embodied therein for controlling connection admission for a connection request in a network, the computer program product having:

computer readable program code for estimating an equivalent cell rate (ECR) based on

description of the connection request, the description including a booking factor;

computer readable program code for estimating a measured utilization factor for admitted

connections in the network using measurements of data streams arriving at queues and the

booking factor; and

computer readable program code for generating an admission decision for the connection

request based on the estimated ECR and the estimated measured utilization factor.

26.   (Original)   The computer program product of claim 25 wherein the description

of the connection request further includes a connection descriptor and a quality of service (QoS)

descriptor.

27.   (Original)   The computer program product of claim 26 wherein the connection

descriptor includes at least one of a cell rate, a transport device speed, a queue depth, a cell loss

ratio, and a link capacity.

28.   (Original)   The computer program product of claim 26 wherein the cell rate is

one of a peak cell rate (PCR), a sustained cell rate (SCR), a maximum burst size (MBS), and a

minimum cell rate (MCR).

29.   (Original)   The computer program product of claim 28 wherein the QoS

descriptor is one of a constant bit rate (CBR), a real-time variable bit rate (rt-VBR), a non-real-

time variable bit rate (nrt-VBR), an unspecified bit rate (UBR), an available bit rate (ABR), and

a guaranteed frame rate (GFR).

30.   (Original)   The computer program product of claim 29 wherein the computer

readable program code for estimating the ECR comprises:

computer readable program code for providing a scale factor using a look-up table, the

look-up table having entries computed for the QoS descriptor, the entries being indexed by the

connection descriptor; and

computer readable program code for scaling the cell rate corresponding to the QoS using the scale factor , the scaled cell rate corresponding to the estimated ECR.

31.   (Original)   The computer program product of claim 30 wherein the look-up table is one of a CBR look-up table and a VBR look-up table, the CBR look-up table corresponding to the CBR, the VBR look-up table corresponding to the VBR.

32.   (Original)   The computer program product of claim 31 wherein the CBR look-up table is indexed by a cell rate parameter and the transport device speed, the cell rate parameter being within a range from unity to the PCR.

33.   (Original)   The computer program product of claim 32 wherein the scale factor is one of the entries indexed by the cell rate parameter and the transport device speed.

34.   (Original)   The computer program product of claim 31 wherein the VBR look-up table is indexed by a first ratio between the queue depth and the MBS and a second ratio between the link capacity and the PCR.

35.   (Original)   The computer program product of claim 34 wherein the scale factor is a weighted value from entries nearest to an entry corresponding to the first and second ratios when there is no exact match with at least one of the first and second ratios.

36.   (Original)   The computer program product of claim 25 wherein the computer readable program code for estimating the measured utilization factor comprises:
     computer readable program code for estimating a minimum resource needed for the admitted connections meeting quality of service (QoS) requirements within a measurement window by a capacity estimator; and
     computer readable program code for generating the measured utilization factor using the estimated minimum resource and measurement parameters by a measured utilization factor generator.

37. (previously presented) A system interfacing to a network, the system comprising:

a plurality of queues to receive data streams; and

a circuit to control connection admission for a connection request in the network, the circuit comprising;

a first estimator to estimate an equivalent cell rate (ECR) based on description of the connection request, the description including a booking factor;

> a second estimator to estimate a measured utilization factor for admitted
> connections in the network using measurements of the data streams arriving at the
> queues and the booking factor; and
> a controller coupled to the first and second estimators to generate an admission
> decision for the connection request based on the estimated ECR and the estimated
> measured utilization factor.

38. (Original) The system of claim 37 wherein the description of the connection request further includes a connection descriptor and a quality of service (QoS) descriptor.

39. (Original) The system of claim 38 wherein the connection descriptor includes at least one of a cell rate, a transport device speed, a queue depth, a cell loss ratio, and a link capacity.

40. (Original) The system of claim 38 wherein the cell rate is one of a peak cell rate (PCR), a sustained cell rate (SCR), a maximum burst size (MBS), and a minimum cell rate (MCR).

41. (Original) The system of claim 40 wherein the QoS descriptor is one of a constant bit rate (CBR), a real-time variable bit rate (rt-VBR), a non-real-time variable bit rate (nrt-VBR), an unspecified bit rate (UBR), an available bit rate (ABR), and a guaranteed frame rate (GFR).

42. (Original) The system of claim 41 wherein the first estimator comprises:

a scale factor generator to provide a scale factor, the scale factor generator comprising a look-up table having entries computed for the QoS descriptor, the entries being indexed by the connection descriptor; and

a scaler coupled to the scale factor generator to scale the cell rate corresponding to the QoS using the scale factor, the scaled cell rate corresponding to the estimated ECR.

43.   (Original)   The system of claim 42 wherein the look-up table is one of a CBR look-up table and a VBR look-up table, the CBR look-up table corresponding to the CBR, the VBR look-up table corresponding to the VBR.

44.   (Original)   The system of claim 43 wherein the CBR look-up table is indexed by a cell rate parameter and the transport device speed, the cell rate parameter being within a range from unity to the PCR .

45.   (Original)   The system of claim 44 wherein the scale factor is one of the entries indexed by the cell rate parameter and the transport device speed.

46.   (Original)   The system of claim 43 wherein the VBR look-up table is indexed by a first ratio between the queue depth and the MBS and a second ratio between the link capacity and the PCR.

47.   (Original)   The system of claim 46 wherein the scale factor is a weighted value from entries nearest to an entry corresponding to the first and second ratios when there is no exact match with at least one of the first and second ratios.

48.   (Original)   The system of claim 37 wherein the second estimator comprises:
a capacity estimator to estimate a minimum resource needed for the admitted connections meeting quality of service (QoS) requirements within a measurement window; and

a measured utilization factor generator coupled to the capacity estimator to generate the measured utilization factor using the estimated minimum resource and measurement parameters.

49.   (previously presented)   An apparatus for controlling connection admission for a connection request in a network, comprising:

means for estimating an equivalent cell rate (ECR) based on description of the connection request, the description including a booking factor;

means for estimating a measured utilization factor for admitted connections in the network using measurements of data streams arriving at queues and the booking factor; and

means for generating an admission decision for the connection request based on the estimated ECR and the estimated measured utilization factor.

50.   (previously presented)   The apparatus of claim 49 wherein the description of the connection request further includes a connection descriptor and a quality of service (QoS) descriptor.

51.   (previously presented)   The apparatus of claim 50 wherein the connection descriptor includes at least one of a cell rate, a transport device speed, a queue depth, a cell loss ratio, and a link capacity.

52.   (previously presented)   The apparatus of claim 50 wherein the cell rate is one of a peak cell rate (PCR), a sustained cell rate (SCR), a maximum burst size (MBS), and a minimum cell rate (MCR).

53.   (previously presented)   The apparatus of claim 52 wherein the QoS descriptor is one of a constant bit rate (CBR), a real-time variable bit rate (rt-VBR), a non-real-time variable bit rate (nrt-VBR), an unspecified bit rate (UBR), an available bit rate (ABR), and a guaranteed frame rate (GFR).

54.   (previously presented)   The apparatus of claim 53 wherein the means for estimating an ECR comprises:

means for providing a scale factor using a look-up table, the look-up table having entries computed for the QoS descriptor, the entries being indexed by the connection descriptor; and,

means for scaling the cell rate corresponding to the QoS using the scale factor, the scaled cell rate corresponding to the estimated ECR.

55.   (previously presented)   The apparatus of claim 54 wherein the look-up table is one of a CBR look-up table and a VBR look-up table, the CBR look-up table corresponding to the CBR, the VBR look-up table corresponding to the VBR.

56.   (previously presented)   The apparatus of claim 55 wherein the CBR look-up table is indexed by a cell rate parameter and the transport device speed, the cell rate parameter being within a range from unity to the PCR .

57.   (previously presented)   The apparatus of claim 56 wherein the scale factor is one of the entries indexed by the cell rate parameter and the transport device speed.

58.   (previously presented)   The apparatus of claim 55 wherein the VBR look-up table is indexed by a first ratio between the queue depth and the MBS and a second ratio between the link capacity and the PCR.

59.   (previously presented) The apparatus of claim 58 wherein the scale factor is a weighted value from entries nearest to an entry corresponding to the first and second ratios when there is no exact match with at least one of the first and second ratios.

60.   (previously presented)   The apparatus of claim 49 wherein the means for estimating a measured utilization factor comprises:
    means for estimating a minimum resource needed for the admitted connections meeting quality of service (QoS) requirements within a measurement window by a capacity estimator; and
    means for generating the measured utilization factor using the estimated minimum resource and measurement parameters by a measured utilization factor generator.